

Advanced in vitro exposure systems



APPLICATION NOTE
AN-15
November 2025



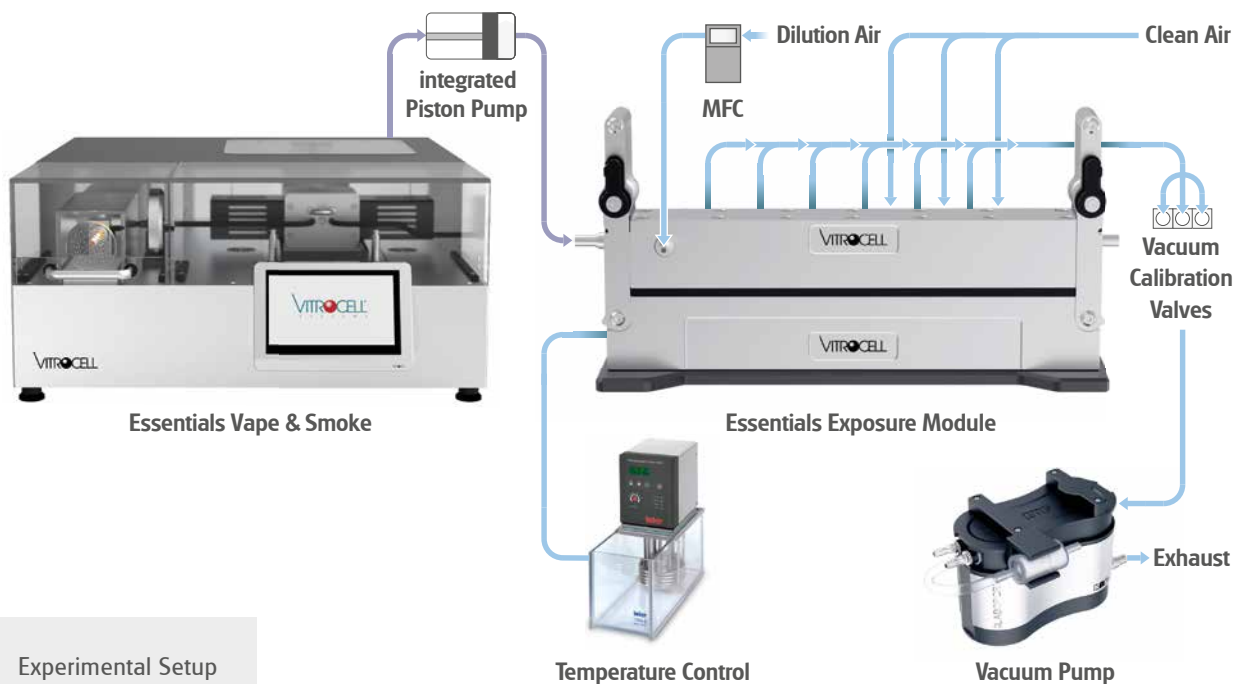


DIN EN ISO 9001
varISO certified

Uniform aerosol distribution with VITROCELL® Essentials – 12- and 24-well results (0.25–4 L/min)

The VITROCELL® Essentials Exposure System is a compact exposure module for 12- and 24-well sized inserts, designed to simplify *in vitro* exposures with essential functionality. It features exchangeable aerosol inlets and water-bath heating

of top and base modules, includes media covers, and is compatible with isokinetic sampling. The module provides three exposure positions and three clean air positions, offering a streamlined, cost-effective entry into ALL studies.



Experimental Setup

Study rationale

This internal study was conducted to demonstrate that the VITROCELL® Essentials Exposure System evenly distributes a diluted tobacco smoke aerosol from a 1R6F reference cigarette across positions while maintaining predictable, flow-based dose control.

Measurement of distribution

To determine how the tobacco smoke aerosol was distributed within the system, the total particulate matter (TPM) was collected in stainless steel inserts. The TPM captured in DMSO was then analyzed using fluorescence measurement. Tobacco smoke particles emit fluorescence at 485 nm when excited with light at 355 nm. This property allows the amount of smoke constituents to be quantified based on their fluorescence intensity (FI).

12-well results (0.25–4 L/min)

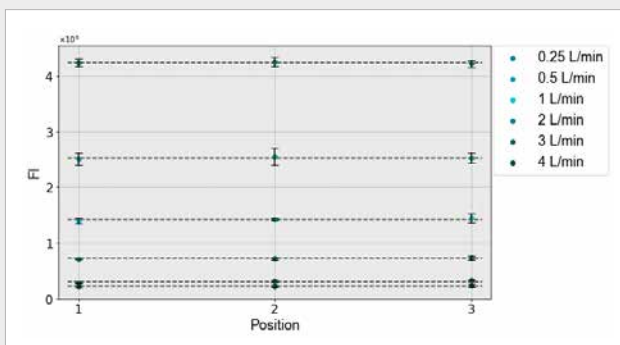


Fig. 1: FI by position/flow: Comparable FI across positions 1–3 at every flow; no positional drift.

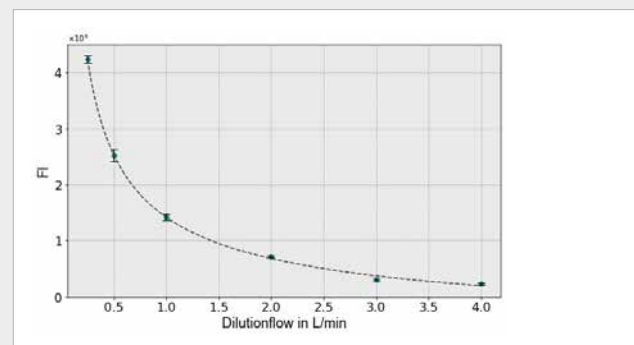


Fig. 2: FI vs. flow: FI decreases with higher flow; dashed line guides the inverse trend; mean ± SD.

Executive summary

Across all dilution flows, relative deposition at positions 1–3 remains within the 85–115 % acceptance band, with low variance between repeats (error bars = SD). Fluorescence intensity (FI) used as tracer decreases monotonically with increasing flow, confirming a broad, controllable dose range without positional bias.

Graphical Data Description

Bar charts: Mean relative deposition (normalized to 100 %); error bars = SD. Orange dashed lines denote the 85–115 % acceptance window.

FI plots: FI vs. dilution flow and FI by position/flow to visualize dose control and check for positional trends.

Experimental setup (summary)

12-well configuration of VITROCELL® Essentials; dilution flows 0.25 / 0.5 / 1 / 2 / 3 / 4 L/min; readout FI and relative deposition per position; multiple repeats; SD shown.

Results & interpretation

Uniformity: Means cluster near 100 % at each flow; no systematic inlet-to-outlet gradient across positions 1–3.

Dose control: FI falls with increasing flow (inverse trend), enabling well-spaced dose levels.

Reproducibility: Low SD across conditions; slightly larger SD at the highest dilutions is expected and does not breach the acceptance window.

Figure captions (12-well)

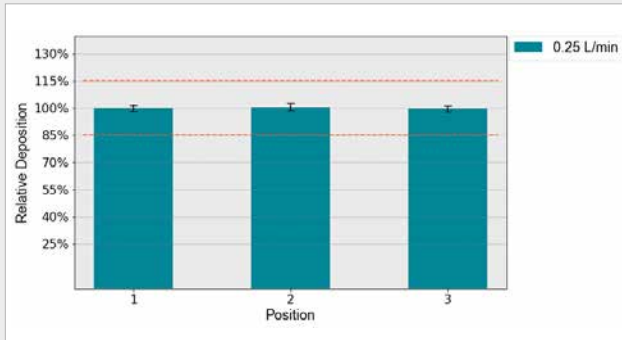


Fig. 3: 0.25 L/min: Relative deposition at positions 1–3; all means within 85–115 %; mean ± SD.

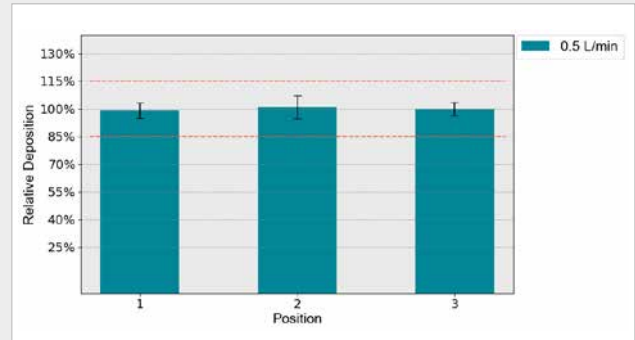


Fig. 4: 0.5 L/min: Uniform distribution; low variability. means within 85–115 %; mean ± SD.

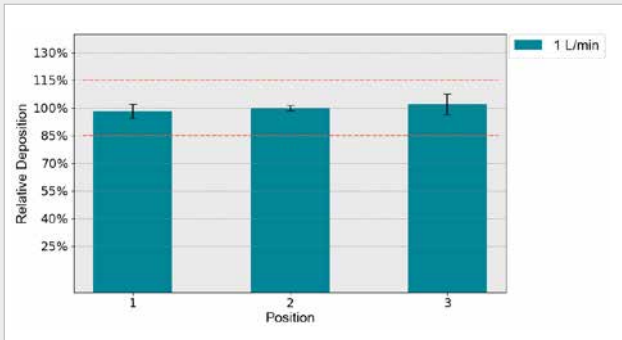


Fig. 5: 1 L/min: Means centered near 100 %; homogeneous across positions.

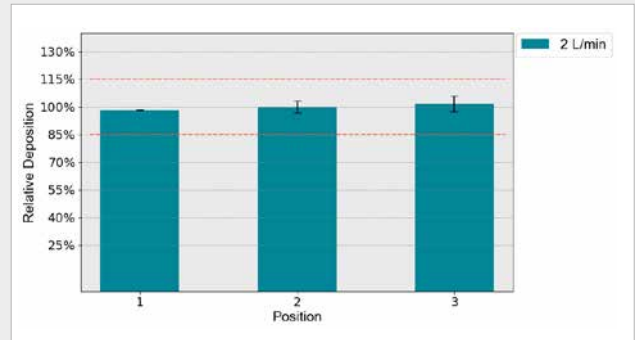


Fig. 6: 2 L/min: Consistent distribution within acceptance; moderate SD.

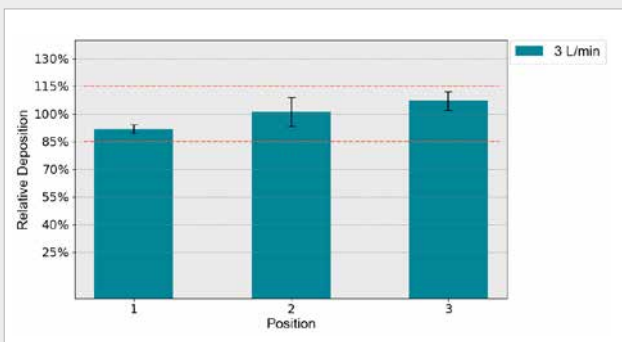


Fig. 7: 3 L/min: Slightly higher SD at low dose; means stay in-range.

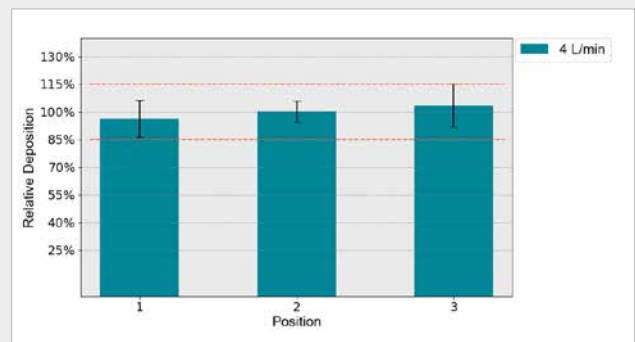


Fig. 8: 4 L/min: Stable means within acceptance; modest variance.

24-well results (0.25–4 L/min)

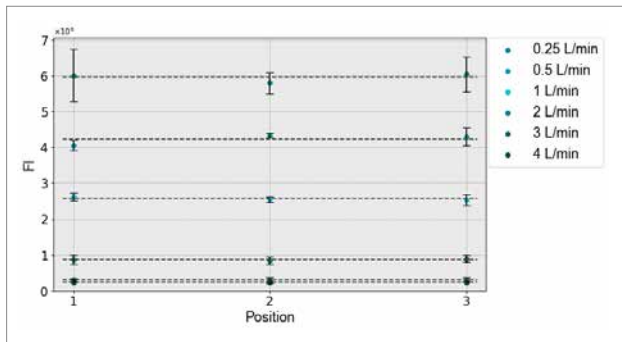


Fig. 9: FI by position/flow: Comparable FI across positions 1–3 at each flow; uniform distribution confirmed.

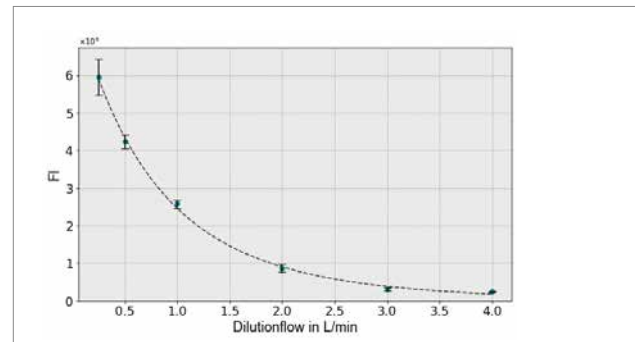


Fig. 10: FI vs. flow: FI decreases with increasing flow; dashed line guides expected trend; mean \pm SD.

Executive summary

In the 24-well format, VITROCELL® Essentials maintains homogeneous aerosol deposition from 0.25 to 4 L/min. Means at positions 1–3 remain inside the 85–115 % window. Variability rises moderately at the lowest doses (e.g., around 3 L/min), as expected, yet means stay in-range. The FI vs. flow curve again confirms predictable, inverse dose-to-flow behavior.

Graphical Data Description

Bar charts: Mean relative deposition per position (normalized to 100 %); SD shown; acceptance band at 85–115 %.

FI plots: FI vs. flow and FI by position/flow to assess dose control and positional uniformity.

Experimental setup (summary)

24-well configuration of VITROCELL® Essentials; dilution flows 0.25 / 0.5 / 1 / 2 / 3 / 4 L/min; readout FI and relative deposition; multiple repeats; SD shown.

Results & interpretation

Uniformity: Position-wise means cluster near 100 % across all flows; no directional trend between positions 1–3.

Dose control: Monotonic FI decrease with increasing dilution flow supports robust dose-response designs.

Reproducibility: Small-to-moderate SD across flows with consistent positional homogeneity.



Essentials Exposure Module Top

Figure captions (24-well)

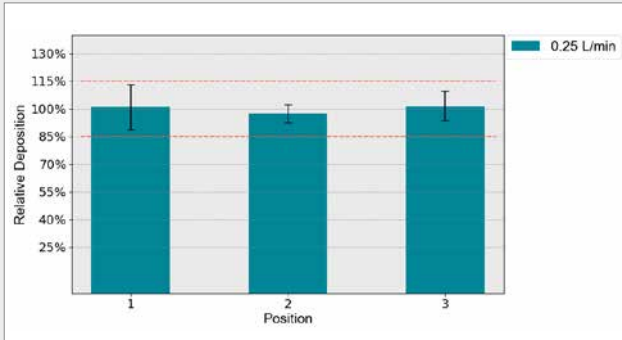


Fig. 11: 0.25 L/min: Relative deposition at positions 1–3; all means within 85–115 %; mean ± SD.

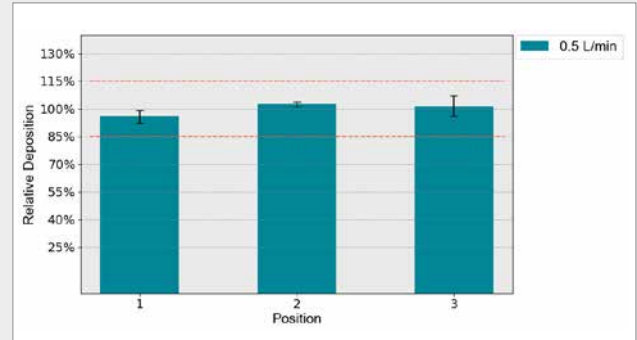


Fig. 12: 0.5 L/min: Uniform distribution; low variability.

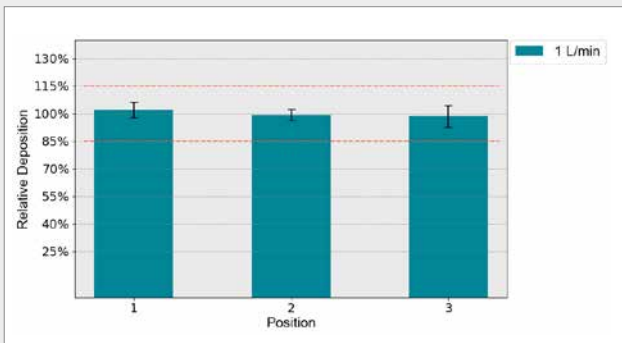


Fig. 13: 1 L/min: Means near 100 %; homogeneous across positions.

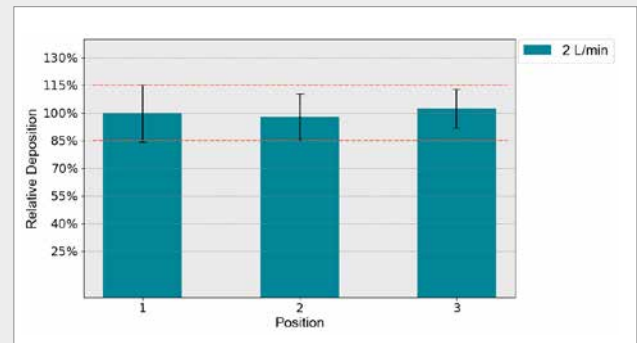


Fig. 14: 2 L/min: Consistent, in-range means; moderate SD as dose decreases.

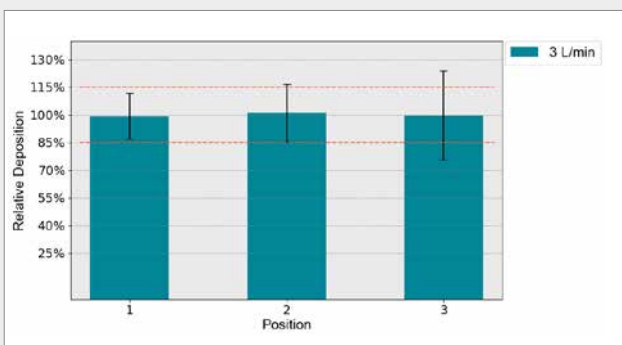


Fig. 15: 3 L/min: Slightly higher SD at low dose; means remain in-range.

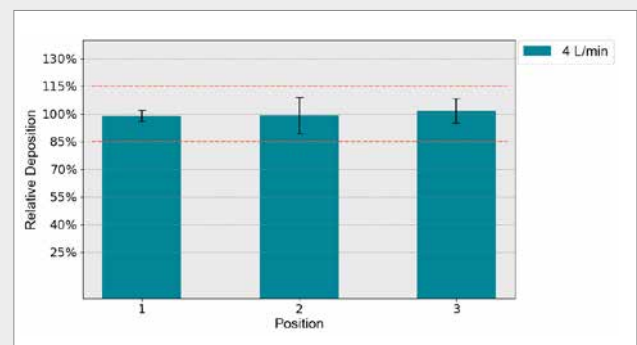


Fig. 16: 4 L/min: Stable means within acceptance; no systematic positional trend.

About VITROCELL®

VITROCELL® exclusively concentrates on the developing, producing, installing, training and servicing of advanced *in vitro* exposure systems.

The VITROCELL® Systems' team is driven by their vision for new *in vitro* standards through state-of-the-art technology, highly qualified workmanship and absolute client dedication. VITROCELL® has successfully collaborated with clients from leading research institutes, contract research organizations, regulatory authorities or industrial laboratories across the world. Working with our team experts, all modules have been tailored to create durable and complete turnkey-systems for *in vitro* inhalation toxicology. Gases, environmental atmospheres, nano particles and complex mixtures are analyzed on lung cells at the air/liquid interface using these systems. VITROCELL® technologies are also applicable to solutions for skin research.

Over a decade of devotion to research in this specific field has given our team of design & precision manufacturing specialists the opportunity to mentor highly diversified and complex projects from conception to completion. We strive to become a constructive member of each research team, providing support when it is needed, advice when it is required and modules of the highest quality, which are even polished by hand before leaving here to be integrated into your workspace. Every piece of our German engineered equipment is manufactured to the highest of standards – yours.

For more information please scan the QR-Code:



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